

MCCALL SUMMER CHINOOK SALMON HATCHERY

1993 BROOD YEAR PRODUCTION REPORT

Prepared for U.S. Fish and Wildlife Service

by

Donald E. McPherson

Fish Hatchery Superintendent III

Doug Munson
Fish Pathologist

JULY 1995

TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT	1
INTRODUCTION	2
OBJECTIVES	2
FISH REARING FACILITIES	3
WATER SUPPLY	3
STAFFING	4
TRAPPING AND SPAWNING	4
FISH PRODUCTION	6
Early Rearing	6
FISH HEALTH	7
Diseases Encountered and Treatment	7
FISH MARKING	8
FISH DISTRIBUTION	8
EXPERIMENTS	8
CONCLUSION	10
RECOMMENDATIONS	10
APPENDICES	11

LIST OF TABLES

Table 1. Age breakdown of 1993 summer chinook salmon returns to McCall Fish Hatchery, South Fork Salmon River, comparing length frequency and CWT	5
---	---

LIST OF APPENDICES

Appendix A-1.	Lengths of brood year 1993 fish trapped	12
Appendix A-2.	Lengths of brood year 1993 fish ponded	14
Appendix A-3.	Lengths of brood year 1993 fish released	16
Appendix B.	South Fork Salmon River run timing, brood year 1993	18
Appendix C.	South Fork summer chinook run, 1993	20
Appendix D.	Historic releases and returns	21
Appendix E.	Summer chinook distribution in the South Fork of the Salmon River	22
Appendix F.	Brood year 1993 chinook survival from green eggs to released smolts	22
Appendix G-1.	Temperature range from August 1993 through April 1995	23
Appendix G-2.	Temperature range graph through rearing cycle	24
Appendix H.	Water analysis	25
Appendix I.	Brood year 1993 production cost table	25
Appendix J.	Brood year 1993 marked fish that were released	26
Appendix K.	Summary of fish autopsies	27

ABSTRACT

The South Fork Salmon River weir and trap were installed on July 1, 1993, and removed at the conclusion of trapping on September 7, 1993.

Chinook salmon Oncorhynchus tshawytscha spawning at the trap commenced on August 9 and concluded on September 3, 1993. A total of 2,703 returning chinook salmon were trapped, measured, and recorded during this period. The overall average eye-up from eggs taken was 91.5%, with a total survival to release of 75.7%.

Of the 2,703 fish trapped, 1,487 were females of which 568 were ponded, 890 were released upstream of the weir, 100 were trucked to the Stolle Meadows area, 29 were given to the Sho-Ban tribe, and 41 died in the pond for a pre-spawn mortality rate of 7%. There were 1,188 adult males trapped of which 480 were ponded, 684 released upstream of the weir, 99 transported to the Stolle Meadows area, 24 were given to the Sho-Ban tribe, and 47 died in the pond for a pre-spawn mortality rate of 9.7%. There were 28 jacks trapped (according to length frequency criteria), 7 were ponded, 20 were released upstream, 1 was given to the Sho-Ban tribe, and 1 of the released Jacks was transported to Stolle Meadows.

From the 568 females ponded, 356 were spawned with an average fecundity rate of 4,863 eggs per female, resulting in 1,731,515 green eggs taken.

During the fall of 1994, there were 236,334 pre-smolts released into the South Fork Salmon river and its tributaries. During April 1995, there were 1,074,598 broodyear 1993 smolts weighing 49,293 pounds transported and released at Knox Bridge on the South Fork Salmon River.

Author:

Donald E. McPherson
Fish Hatchery Superintendent III

INTRODUCTION

McCall Fish Hatchery was built in 1979 as a result of the Water Resources Development Act enacted by Congress in 1976. A portion of this act is the Lower Snake River Fish and Wildlife Compensation Plan (LSRCP). The LSRCP compensates Idaho for fish and wildlife losses caused by the Lower Snake River Projects (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams). The McCall Hatchery was the first hatchery built as a partial fulfillment of the LSRCP. Funding for LSRCP is administered to the Idaho Department of Fish and Game (IDFG) by the U.S. Fish and Wildlife Service.

The McCall Hatchery is located within the city limits of McCall, Idaho along the North Fork of the Payette River, approximately 0.16 km (1/4 mile) downstream from Payette Lake.

A satellite facility for trapping and spawning adult chinook salmon Oncorhynchus tshawytscha is located on the South Fork Salmon River near Warm Lake, approximately 26 miles east of Cascade, Idaho.

The main production for McCall Fish Hatchery is summer chinook reared to smolt size. There is also a resident trout program funded solely by IDFG.

The first salmon reared at the McCall Fish Hatchery were transferred in from the Mackay Fish Hatchery and the Dworshak/Kooskia National Fish Hatchery complex. These eggs were the product of adult summer chinook trapped at Little Goose and Lower Granite dams. The first eggs from the South Fork of the Salmon River were received in August of 1980.

OBJECTIVES

The mitigation goal is to return 8,000 adult summer chinook salmon above Lower Granite Dam. The objectives of the McCall Fish Hatchery are:

1. Restore summer chinook salmon to the South Fork Salmon River; historically a major summer chinook stream in Idaho.
2. Trap and spawn adult salmon returning to the South Fork Salmon River.
3. Raise 1,000,000 summer chinook smolts for release into the South Fork Salmon River.
4. Work with management and research to identify optimum operating procedures for the McCall Hatchery.

FISH REARING FACILITIES

The hatchery facility consists of six buildings on approximately 15 acres. The largest building consists of a shop, parking garage, incubation and early rearing area, generator room, and feed/freezer room. The office and a three bedroom dormitory are contained in one building. There is a visitor center with restrooms, a flow chart for a self guided tour, and historical information signs. There are three residences for permanent personnel also located on the site.

The fish production facilities include

1. Twenty-six 8-tray stacks of FAL (Flex-A-Lite, Consolidated) vertical flow (Heath type) incubators.
2. Fourteen concrete vats 4-ft x 40-ft x 2-ft (water depth); 320 cubic feet of rearing area per vat.
3. Two concrete rearing ponds 196-ft x 40.5-ft x 4-ft (water depth); 23,814 cubic feet of rearing space per pond.
4. One concrete collection basin 101-ft x 15-ft x 4-ft (water depth). The hatchery is designed to raise a maximum capacity of 1,000,000 smolts, averaging 17 fish per pound.

An adult trapping and spawning facility is located on the South Fork of the Salmon River near Warm Lake. This facility is equipped with a removable weir, fish ladder, trap, two adult holding ponds (10-ft x 90-ft), and a covered spawning area. Water is supplied from the South Fork Salmon River through a 33-inch underground pipeline. Holding capacity for the facility is approximately 1,000 adult salmon. Some adults are passed above the weir to spawn naturally. An additional group is transported to Stolle Meadows for Idaho Supplementation research. Eggs collected at the facility are transported "green" to McCall for incubation and rearing.

WATER SUPPLY

Hatchery water is obtained by gravity flow from Payette Lake through a 36-inch underground pipeline. Water may be taken from the surface or up to a depth of 50 feet, thus providing the capability of obtaining optimum rearing water temperatures.

Through an agreement with the Payette Lake Reservoir company, 20 cubic feet per second (cfs) of water flow is available for hatchery use. Design criteria and production goals were established using this constraint, ensuring the hatchery has enough water to meet its production goals.

Water quality analysis reveals a somewhat "distilled" system for rearing fish (Appendix H). Total hardness ranges from 6.3 to 7.06 mg CaCO₃/l, while pH stays about 6.8. There is no indication of problems with heavy metals and temperature is maintained at 52°F to 56°F, with a low of 37°F.

STAFFING

The hatchery is staffed with three permanent employees: a Hatchery Superintendent III, a Hatchery Superintendent I, and a Fish Culturist. In addition there are four temporary employees to assist during the busy field season.

TRAPPING AND SPAWNING

The weir and trap on the South Fork Salmon River was installed and operational on July 1, 1993, and trapping continued through September 7, 1993. The first fish were trapped on July 2. Normal trap installation is usually around June 20 with the fish arriving shortly thereafter. The peak of the run for 1993 was July 31.

There were 2,703 fish trapped; 1,487 (55%) were females, and 1,216 (45%) were males. A total of 28 male fish (1%) were jacks (3-year-old-fish) according to length frequency criteria. There were 890 females, 684 adult males, and 20 jacks released upstream of the weir. There was an additional 100 pair of adult fish and jacks transported to the Stolle Meadows area and released. These fish were tagged with Peterson disc tags for observation and spawning distribution information.

From the 2,703 fish trapped, there were 723 snouts removed from adipose-clipped fish indicating coded wire tags (CWT). These were sent to the lab in Lewiston, Idaho, for tag removal.

The age class determination by length frequency was used at the trap site during initial trapping. The CWT recovery data and scale analysis show an overlap of age classes originally determined using length frequency. (Table 1).

Table 1. Age distribution of 1993 summer chinook salmon returns to McCall Fish Hatchery, South Fork Salmon River, based on CWT data* and length frequency data.

Age	Males		Females	
	CWT* estimate	Length/ frequency estimate	CWT* estimate	Length/ frequency estimate
3	28	28	0	0
4	527	599	555	764
5	661	589	932	723
Totals	1,216	1,216	1,487	1,487

* CWT data based on 661 tags recovered from 723 snouts and expanded for the entire run. Length data is taken at trapping prior to first sort.

Age class breakdown

66 cm< = 3-year-olds, jacks
 67 cm - 89 cm = 4-year-olds
 90 cm> = 5-year-olds

Fork lengths were taken on all of the fish trapped, and all of the adult fish were injected with Erythromycin (Erythro 200). There were two different dosages tested; half of the fish received a 0.4 cc injection and half received a 0.67 cc injection. Fish were monitored for drug toxicity and increased mortality, but no indications were noted. The released adults received a 0.4 cc dosage.

Early in the run, through July 13, only adipose clipped fish were ponded, and all unmarked fish were released upstream of the weir. After July 13, up to 35% of the unmarked fish were retained to be spawned for supplementation research. There were no marked fish released upstream of the weir

Pre-spawn mortality for the females was 7.0%, with 9.7% for the males. On August 3, there was an electrical short when an electrical cord was pinched. The electrical current passed through a crowd rack and through a bio-aide standing in the female holding pond. The bio-aide was uninjured, the charge went in one arm and out the other and into the water. The fish in both ponds were affected, but the males were hit harder. The mortality was not instant, the fish suffered broken spines and died over a long period of time. Approximately 73 females and 89 males were affected. The injured fish were used for spawning if they ripened before death. There was no increase in bloody or broken eggs from the females, the males were also functional. The eye-up percentage was good. There were 42 females and 65 males that died as a result of the electrical shock that were not included in the pre-spawn mortality. There were 20 adipose clipped males that were sacrificed at the end spawning and snouts removed for coded wire tag recovery.

Spawntaking activities started on August 9 and finished on September 3, 1993. There were ten spawn days during this period. A total of 1,731,515 green eggs were taken from 356 females for an average fecundity rate of 4,863 eggs per female. There were 67 unmarked females spawned for supplementation research, 289 for reserve or production fish. There were 1,405,694 reserve and 325,821 supplementation eggs taken. The eye-up rates were the same for both groups, 91.5%. A total of 352 adult males and 4 jacks were used in the spawning operation. All eggs taken were water-hardened for one hour in a 200 ppm titrateable iodine solution prior to being transported to the hatchery. The fecundity rate is estimated at 4,500 eggs per female until the eye-up stage is reached and the eggs are enumerated. At eye-up, the eggs are shocked by siphon, picked with an electronic picker, and enumerated by displacement and an electronic counter. The overall eye-up percentage was 95.1%, or 1,584,938 eyed eggs.

All of the spawned females were disease sampled by the pathologists from the Eagle lab. There were 41 reserve females testing positive for Bacterial Kidney Disease. It was decided that as there was a surplus of eggs, that the eggs from the reserve females that tested disease positive would be culled. There were 203,689 eggs culled. There were no supplementation eggs culled.

Incubator flows were set at a 5 gallon per minute rate, and incubators were loaded at 2,000 cc, or approximately 8,000 eggs per tray. If space allowed,

1,500 to 1,800 cc of eggs per tray were utilized. The eggs were treated with 1,667 ppm of formalin for 15 minutes starting 3 days after fertilization and continuing on a daily basis until the eggs started to hatch.

Eggs eyed-up at approximately 600 thermal units (TU) and were then shocked, picked, and enumerated. Hatching began at approximately 925 TU.

FISH PRODUCTION

Early Rearing

Fry were sent out to the concrete vats approximately three days prior to initial feeding. Initial feeding begins between 1,750 and 1,775 TU. Flows for the vats are set at 80 gallons per minute and are loaded at 70,000 to 100,000 fish per vat, depending on the number of fish on hand. The vats start at half length and are extended to full length when the density index (DI) reaches 0.30 to 0.35, usually around mid-February.

Beginning growth rates are slow, only 0.003-inch to 0.004-inch per day, due to cold water temperatures of only 37°F to 39°F. The fry are started on Bio-Diet #2 and #3 feed and remain on #3 until they reach 700 fish per pound. Bio-Diet feed has been used successfully at McCall Hatchery using modified feed rates. The conversion rates average 1.1:1 to 1.5:1 during the fry rearing stage.

Fish are moved to the outside rearing ponds the first week of June. They are adipose clipped and enumerated as they are moved out. The ponds are loaded at 541,880 into pond #1 and 550,109 into pond #2. Pond #2 received 233,981 adipose clipped and 316,335 right ventral (RV) fin clipped fish. The RV clipped fish are for supplementation research. (Appendix J).

The fish were fed two medicated feed treatments of Aquamycin, at 2.25 grams of active erythromycin phosphate per 100 pounds of fish at 1% body weight.

FISH HEALTH

Diseases Encountered and Treatment

McCall Hatchery has had an excellent fish health year. Treatments were limited to two prophylactic erythromycin feed treatments of 21 days per treatment. Acute and chronic problems due to etiologic agents were non-existent.

Acute Losses

Acute losses were not experienced at McCall Hatchery this year.

Other Assessments

Fish health programs have been successful at McCall. The most important etiological agent at this hatchery is Renibacterium, which causes a chronic loss during the winter months. McCall hatchery needs a BKD culling program. When this is not possible, due to low chinook returns, a segregation program is justified. High BKD segregation groups should have special care when being reared. Lower density, better feed formulations, longer and more frequent prophylactic treatments of erythromycin medicated feed.

FISH MARKING

The fish marking crew was here in June and marked 1,341,332 fish with 1,782,232 marks. These marks include CWT/Ad-clips, LV (left ventral) clips, AD (adipose) clips, and RV (right ventral) clips.

The marking crew returned in July, September, and March and PIT-tagged 10,498 fish. A portion of these fish were tagged by Russ Kiefer and crew and the rest were done by the regular marking crew in the PIT tagging van. The breakdown of tagged released fish appears in Appendix J.

The crew returned in the early spring prior to release and PIT-tagged 5,100 fish. A portion of these fish were tagged by Russ Kiefer and crew and the rest by the regular marking crew in the PIT tag van. The breakdown of tagged released fish appears in Appendix J.

FISH DISTRIBUTION

The brood year 1993 smolt hauling operation began on April 6, 1994 with the release of the supplementation fish, and concluded on the afternoon of the April 8. Jerry McGehee sent down a crew and three trucks to assist with the hauling operation. There were approximately 25 loads of fish hauled in three days. The river conditions were excellent for the release, the water was coming up and slightly off color. There were four groups of 400 PIT-tagged fish for the time of release study that went out on April 7 (during a storm event), April 12 (during a non-storm event), April 19 (during a storm event), and April 24 (during a non-storm event). All together there were 1,074,598 broodyear 1993 smolts at 21.8 fish per pound totaling 49,293 pounds released.

There was a surplus of reserve or general production fish to meet production needs of approximately 240,000 fish. These fish were released into Cabin Creek, Buckhorn Creek, and at Knox Bridge during the summer and fall of 1994 in cooperation with the Nez Perce and Sho-Ban tribes. These fish were differentially marked with a LV clip and PIT tags. (Appendix E) (Appendix J).

EXPERIMENTS

There are two ongoing experiments carried over to the brood year 1993 chinook. The first is a continuation of the supplementation research. This project is designed in an attempt to generate more returning adults to natural spawning grounds. Supplementation smolts are the prodigy of unmarked adults. These fish were isolated within the hatchery until they could be differentially marked to insure that genetic crossover with hatchery production fish would not occur. When these fish return as adults, a portion will be kept for spawning purposes to continue this program. There were 311,824 smolts released in the supplementation group that received an right ventral (RV) clip. These fish were released at the same time as the normal production group. There were 499 LV-clipped fish containing PIT tags were released in conjunction with the supplementation group.

The other project continued with 1993 smolts is the time of release experiment. There were four groups of 400 PIT-tagged fish released at different times during storm events and non-storm events. The first group was released with the main production group on April 7 during a storm event. When the weather cleared on April 12, the second group was released. The third group was released during a storm event on April 19, and the last group during a non-storm event on April 24 (Appendix E). The survival varied from 42.8% to 32.8%, and the travel times from 39.7 days to 20.4 days for the experimental groups based on PIT tag data at Lower Granite Dam. The general production group projected survival at 41.5% with an average travel time of 38 days. The survival rates could be compromised as the dams were spilling during this time. Group 1, released on April 7, had a travel time of 39.7 days with a survival rate of 42.8%. For group 2, released on April 12, travel time was 29.6 days with a survival rate of 38.6%. Group 3 was released on April 19 with an average travel time of 20.4 days and a survival rate of 32.8%. The fourth and final group, released on April 24, had a travel time of 28.6 days and a survival rate of 37.3%. The survival rates and travel time are reflected by arrival at Lower Granite Dam.

Low phosphate feed with a higher vitamin pack was utilized on the brood year 1993 fish with no adverse effects noted. This resulted in a reduction of total phosphorous in the hatchery effluent water to the minimum detectable amount. (Appendix H)

CONCLUSIONS

The brood year 1993 summer chinook released from McCall Hatchery were in excellent condition at release time. The overall survival rate to Lower Granite Dam was estimated at 40% based on PIT tag recoveries at the dam. This rate was higher than the past year, but the dams were spilling during the period and survival rates could be higher than estimated. The fish were larger, 21.8 fish per pound as opposed to 26 fish per pound last year. The culling program utilized on the BKD positive reserve eggs had a positive effect on the over-all health and condition of the fish. The release pipe and tempering pump were utilized again this year. The fish transport and stocking went smoothly with the assistance of the Clearwater Hatchery crew.

RECOMMENDATIONS

Low phosphate feed with a higher vitamin pack was utilized during the peak rearing cycle with no adverse effects noted. All of the chinook eggs that tested positive for BKD were culled this year as there was a surplus of eggs. It is recommended that this practice be continued if sufficient eggs are available. If there is a low run of adults and the culling capability is not available, isolation and special rearing of BKD high positives through the entire rearing cycle should be implemented. It would also be an improvement if the spawning area was expanded and a spawning table was developed to streamline operations.

A P P E N D I C E S

Appendix A-1. Lengths of brood year 1993 fish trapped.

Fork Length (cm)	Males	Females
46	0	0
47	0	0
48	1	0
49	1	0
50	2	0
51	0	0
52	2	0
53	1	0
54	2	0
55	1	0
56	1	0
57	1	0
58	2	0
59	2	0
60	1	0
61	1	0
62	3	0
63	0	0
64	1	0
65	1	0
66	5	0
67	1	1
68	1	1
69	8	1
70	6	1
71	8	5
72	25	9
73	20	15
74	32	15
75	35	17
76	29	34
77	40	50
78	52	45
79	42	47
80	47	62
81	35	55
82	37	53
83	41	40
84	27	27
85	21	45
86	20	32
87	24	55
88	20	65
89	28	89
90	15	97
91	15	104
92	15	126
93	29	117
94	32	83
95	44	73
96	40	51
97	41	38
98	43	21
99	48	5
100	43	5

28*

101		48	3
102		39	0
103		31	0
104		36	0
105		33	0
106		14	0
107		11	0
108		3	0
109		4	0
110		2	0
111		0	0
112		1	0
113		1	0
114		1	0
115		0	0
Totals**	1,188***	1,216	1,487

* Total jacks.

** These totals reflect lengths taken at trapping prior to first sort.

*** Total males not including jacks.

Appendix A-2. Lengths of brood year 1993 fish ponded.

Fork Length (cm)	Males	Females
46	0	0
47	0	0
48	0	0
49	0	0
50	1	0
51	0	0
52	0	0
53	0	0
54	1	0
55	0	0
56	0	0
57	0	0
58	0	0
59	0	0
60	0	0
61	0	0
62	1	0
63	0	0
64	0	0
65	1	0
66	3	0
67	1	0
68	0	1
69	3	0
70	2	1
71	4	1
72	12	4
73	9	11
74	19	11
75	22	10
76	17	14
77	23	25
78	26	22
79	21	25
80	22	29
81	16	26
82	16	27
83	19	17
84	12	14
85	11	16
86	9	12
87	8	17
88	9	22
89	14	24
90	7	35
91	7	31
92	4	43
93	12	36
94	12	28
95	15	24
96	14	16
97	13	14
98	15	7
99	11	3
100	14	2
101	11	0

102		12	0
103		6	0
104		9	0
105		12	0
106		6	0
107		1	0
108		1	0
109		1	0
110		1	0
111		0	0
112		0	0
113		0	0
114		1	0
115		0	0
Totals**	480***	487	568

* Total jacks.

** These totals reflect lengths taken at trapping prior to first sort.

*** Total males not including jacks.

Appendix A-3. Lengths of brood year 1993 fish released.

Fork Length (cm)	Males	Females
46	0	0
47	0	0
48	1	0
49	1	0
50	1	0
51	0	0
52	1	0
53	1	0
54	1	0
55	1	0
56	1	0
57	1	0
58	2	0
59	2	0
60	1	0
61	1	0
62	2	0
63	0	0
64	1	0
65	0	0
66	20*	0
67	0	1
68	1	0
69	5	1
70	3	0
71	4	3
72	12	3
73	11	4
74	13	4
75	11	6
76	12	20
77	14	25
78	25	23
79	21	21
80	24	32
81	18	28
82	20	25
83	20	23
84	14	12
85	10	29
86	11	19
87	16	36
88	9	41
89	14	63
90	8	60
91	8	70
92	11	79
93	16	79
94	19	55
95	29	47
96	26	35
97	26	24
98	27	14
99	36	2
100	29	3
101	37	3

102		27	0
103		25	0
104		26	0
105		21	0
106		7	0
107		10	0
108		2	0
109		3	0
110		1	0
111		0	0
112		1	0
113		1	0
114		0	0
115		0	0
Totals**	684***	704	890

* Total jacks.

** These totals reflect lengths taken at trapping prior to first sort.

*** Total males not including jacks.

Appendix B. South Fork Salmon River run timing, brood year 1993.

Date	Total Run	Males	Females	Jacks
Jul 02	3	2	1	0
Jul 03	0	0	0	0
Jul 04	0	0	0	0
Jul 05	1	1	0	0
Jul 06	5	1	4	0
Jul 07	5	1	4	0
Jul 08	6	3	3	0
Jul 09	5	3	2	0
Jul 10	13	3	10	0
Jul 11	9	5	4	0
Jul 12	22	10	11	1
Jul 13	16	9	7	0
Jul 14	22	9	13	0
Jul 15	19	10	9	0
Jul 16	18	9	9	0
Jul 17	20	9	11	0
Jul 18	20	13	7	0
Jul 19	24	12	12	0
Jul 20	55	24	31	0
Jul 21	15	5	10	0
Jul 22	136	49	87	0
Jul 23	99	61	36	2
Jul 24	68	31	37	0
Jul 25	86	34	50	2
Jul 26	55	20	34	1
Jul 27	84	32	49	3
Jul 28	32	17	15	0
Jul 29	151	76	73	2
Jul 30	103	54	48	1
Jul 31	205	96	108	1
Aug 01	173	90	82	1
Aug 02	89	38	49	2
Aug 03	89	32	56	1
Aug 04	94	44	49	1
Aug 05	77	33	43	1
Aug 06	46	20	25	1
Aug 07	100	49	47	4
Aug 08	90	35	55	0
Aug 09	56	25	30	1
Aug 10	16	8	8	0
Aug 11	27	6	20	1
Aug 12	25	10	15	0
Aug 13	49	35	14	0
Aug 14	42	19	23	0
Aug 15	48	19	28	1
Aug 16	84	40	43	1
Aug 17	35	20	15	0
Aug 18	49	16	33	0
Aug 19	30	7	23	0
Aug 20	48	14	34	0

Appendix B. Continued

Date	Total Run	Males	Females	Jacks
Aug 21	39	7	32	0
Aug 22	28	6	22	0
Aug 23	9	1	8	0
Aug 24	10	0	10	0
Aug 25	10	3	7	0
Aug 26	4	1	3	0
Aug 27	5	1	4	0
Aug 28	6	0	6	0
Aug 29	5	1	4	0
Aug 30	7	4	3	0
Aug 31	2	1	1	0
Sep 01	2	0	2	0
Sep 02	3	1	2	0
Sep 03	6	1	5	0
Sep 04	1	0	1	0
Sep 05	1	1	0	0
Sep 06	0	0	0	0
Sep 07	1	1	0	0
Totals	2,703	1,188	1,487	28

Appendix D. Historic hatchery releases and returns.

Brood year	Release Year	Number of fish	3-year-olds	Year returned	4-year-olds	Year returned	5-year-olds	Year returned	Percent returned
1978	1980	124,800	124	1981	462	1982	161	1983	0.598
1979	1981	248,926	48	1982	272	1983	221	1984	0.217
1980	1982	122,247	504	1983	713	1984	151	1985	1.119
1981	1983	183,896	595	1984	1259	1985	203	1986	1.119
1982	1984	269,880	828	1985	1265	1986	202	1987	0.850
1983	1985	564,405	1222	1986	2117	1987	893	1988	0.674
1984	1986	970,348	386	1987	1392	1988	191	1989	0.255
1985	1987	958,300	50	1988	252	1989	30	1990	0.035
1986	1988	1,060,400	495	1989	911	1990	154	1991	0.147
1987	1989	975,000	28	1990	237	1991	25	1992	0.029
1988	1990	1,032,500	821	1991	2617	1992	1311	1993	0.030
1989	1991	708,600	206	1992	1364	1993	299	1994	0.263
1990	1992	901,500	28	1993	158	1994	0	1995	---
1991	1993	607,298	70	1994	0	1995	0	---	---
1992	1994	1,060,163	0	1995	0	0	0	---	---
1993	1995	1,074,598	0	1996	---	---	---		

Appendix E. Summer chinook distribution in the South Fork of the Salmon River.

Destination	Weight	Number/pound	Number released
Knox Bridge	24,757.8	21.80	539,721
Knox Bridge	24,462.5	21.80	533,282
Knox Bridge	18.2	21.80	396
Knox Bridge	18.2	21.80	399
Knox Bridge	18.3	21.80	400
Knox Bridge	18.3	21.80	400
Cabin Creek*	449.4	113.84	51,163
Buckhorn Creek*	342.4	105.89	36,259
Buckhorn Creek*	101.6	86.02	8,740
Knox Bridge*	3,560.7	39.37	140,172
Total Released	53,747.4		1,310,932

*These fish were released summer and fall of 1994.

Appendix F. Brood year 1993 chinook survival from green eggs to released smolts.

Number of green eggs	Number of eyed eggs	Percent survival	Ponded	Percent survival	Released smolts	Percent survival
1,731,515	1,584,938	92%	1,341,332*	77.4	1,310,932	75.7%

*There were 203,689 eyed eggs culled due to testing BKD positive.

Appendix G-1. Temperature range from August 1993 through April 1995.

Date	Temperature
08/93	54.0
09/93	50.5
10/93	47.7
11/93	44.1
12/93	38.7
01/94	38.0
02/94	38.0
03/94	38.0
04/94	39.4
05/94	43.7
06/94	49.4
07/94	55.3
08/94	50.3
09/94	50.3
10/94	48.0
11/94	43.0
12/94	38.5
01/95	38.0
02/95	38.0
03/95	38.0
04/95	39.0

Appendix H. Water analysis.

Date	pH	Ammonia	Nitrate	Nitrite	Total phosphate	Total nitrogen	KJEL hardness	CaCO ₂ saturation	Oxygen ppm
1988	6.8	-	-	-	-	-	<10	97/103	7/10
1991		<0.05	<0.1	<0.1	<0.05	<0.10			
1993	6.9	<0.05	<0.1	<0.01	<0.05	<0.10			
1994	6.9	<0.05	<0.1	<0.01	0.01	<0.10			

Appendix I. Brood year 1993 production cost table.

Number	Pounds	Cost	Pounds		Total	Cost/	Cost/
of fish	of feed	of feed	of fish	Conversion	cost	1,000	pound
1,310,932	69,657	\$59,208	53,747	1.29	\$342,960	\$261.80	\$6.38

Appendix J. Brood year 1993 marked fish that were released.

Date	Number of fish marked	Mark	Purpose	Number marked fish released	Site/group release
06/8-6/13	249,343	LV	Tribal	236,334	236,334
06/6-6/10	440,900	AD/CWT	US-Canada	436,532	1,074,598
06/6-6/14	334,754	AD	Identification	326,242	1,074,598
06/6-6/13	316,335	RV	Supplementation	311,824	1,074,598
7/19	2,000	PIT	Tribal	1,999 *	236,334
9/19	1,000	PIT	Tribal	1,000 *	236,334
2/17-2/18	1,600	PIT	Time/Release	1,595 *	1,074,598
2/18	499	PIT	Supplementation	499 *	1,074,598
2/16-2/17	2,000	PIT	Fish Passage	1,996 *	1,074,598
3/1	3,399	PIT	Adult Return Eval.	3,399 *	1,074,598
Total	1,341,332			1,310,932	1,310,932

* Included in ad-clip, supplementation, and tribal groups.